

ON NEW OR LITTLE KNOWN SPECIES OF PHASMIDÆ. PART I,—*Genus Bacillus*,—by JAMES WOOD-MASON of *Queen's College, Oxford*.

(Read 7th August, 1872; received February 9th, 1873).

[With plates V, VI and VII.]

The difficulties that have hitherto defied all attempts at anything like a philosophical and natural classification of this interesting and truly remarkable family of Orthopterous Insects, although in a great measure due to the extraordinary extent to which protective modification has involved all parts of the body throughout the group, must be in part, at any rate, ascribed to our ignorance in so many cases of the opposite sexes of the species; and the discovery that *Acanthoderus lacertinus*, Westw. is the female of *Lonchodes luteoviridis* of the same author, renders it extremely probable that these latter difficulties will be found to be further complicated by other cases of the same nature. As instances of the value of a knowledge of the opposite sexes in the limitation of genera, I need only adduce the fact that the capture of *Acanthoderus bicoronatus*, West., and *Acanthoderus semiarmatus*, Westw., in copulá with their respective males will necessitate the removal of those species, together with their allies, to the genus *Lonchodes*. Thus at the very outset of my researches, I am enabled, by the inestimable advantage of a residence in the great distributional area or metropolis of the family, to withdraw from a genus some of the most *bizarre* of its extremely heterogeneous contents. Since the publication in 1859 of Professor Westwood's classical Monograph of the family, a large number of new or imperfectly known species has been described or remarked upon by various authors,\* but chiefly by

\* Giebel, Zeitschrift für d. gesamt. Naturwissensch. xviii, p. 113.

Stål, Ofversigt af Kon. Vetensk. Akad. Förhand. xv, p. 303.

Coquerel, Ann. Soc. Entom. Fr. 1861, p. 495, pl. 9, fig. 1; Bull. Soc. Ent. Fr. 1866, pp. xxiii-xxiv.

Westwood, Proc. Ent. Soc. Lond, 1864, p. 16; Ann. Soc. Ent. Fr. 4e Sér. t. iv, pl. 6.

Walsh, Proc. Ent. Soc. Phil., iii, p. 409.

Philippi, Stettin Ent. Zeit. 1865, p. 64.

Murray, Ann. and Mag. N. H. 3rd Ser. xviii, p. 265-268.

Kaup, Proc. Zool. Soc. Lond. 1866, pp. 577-578.

Scudder, Proc. Bost. Soc. Nat. Hist. xii, pp. 99 and 340.

Lucas, Ann. Soc. Ent. Fr. 4me Série, t. ix, Bulletin, p. xxv.

Gerstæcker, Archiv für Naturgesch. xxxv, p. 211.

Bates,\* de Saussure† and Kaup‡ whom I mention by name on account of the extent and of the extreme value of their contributions. These numerous additions will be enumerated under the genera to which they belong.

GENUS 1.—BACILLUS, LATR.

Eleven new species have been referred to this genus since the appearance of Professor Westwood's monograph; of these one, viz., *B. patellifer*, Bates, is nearly certainly identical with *B. ? Artemis*, Westw., and two others, viz. *B. gramineus* and *aspericollis*, Bates, are most probably, as indeed the author of those species himself suspects, the opposite sexes of one species. The necessary deductions being made, eight remain, which, added together with those described below to the thirty-eight recognized by Westwood, bring up the total of known species of *Bacillus* to fifty-five.

BACILLUS FUSCOLINEATUS, n. sp. Pl. V. Fig. 7.

♂ Extremely slender, filiform, cylindrical. Antennæ of the length of the metathorax, 17-jointed; first joint depressed but not expanded, carinate above, with sub-parallel margins, the inner one of which is raised; second joint nearly twice as long as broad, sub-depressed; the rest filiform. Head scarcely narrowed from the eyes; a brown streak passes from the eye along

\* Descriptions of Fifty-two New Species of Phasmidæ, with Remarks on the Family, Trans. Linn. Soc. Lond. Vol. xxv, pt. I, pp. 321-359, pl. xlv, xlv.

† Rev. et Mag. de Zool. 1859.

Ann. de la Soc. Ent. de Fr. iv, Sér.

Rev. et Mag. Zool. 1861.

Phasmidarum nov. species nonnullæ. Rev. et Mag. de Zool. 1868. pp. 63-70.

Mélanges Orthoptérologiques, 2me Fasc. Mém. Soc. Phys. de Genève, xx, pt. 1, pp. 227-326, pl. 2, 3.

‡ Ueber die Eier der Phasmiden. Berlin Entomologische Zeitschrift, Vol. 15, 1870. Neue Phasmidæ.

*Bacillus (Ramulus) Humberti*, ♂ ♀, (= *Lonchodes* sp.) Saussure, Ann. Soc. Ent. Fr. 1861, p. 469. Hab. Ceylon.

*Bacillus (Baculum) ramosus*, ♀, Sauss. Revue de Zool. 1861, 128, et Mém. Orth. Fasc. II, p. 114. Hab. Brazil. (?)

*Bacillus carinulatus*, Sauss. ♂ ♀, Revue de Zool. 1868, 63 1. et Mém. Orth. 1869. Fasc. II, p. III, Pl. II, fig. 1. ♀ Hab. Ceylon.

*Bacillus gramineus*, Bates, ♂ Trans. Lin. Soc. Lond. 1865, pt. I, p. 326, pl. xlv, fig. 4. Hab. Natal.

*Bacillus aspericollis*, Bates, ♀, l. c., p. 327. Hab. Natal.

*Bacillus Guenzii*, Bates, ♂ l. c., p. 327, Pl. xlv, f. 14 a. Hab. Natal.

*Bacillus patellifer*, Bates, ♀ (? = *Bacillus ? Artemis*, Westwood), l. c., p. 323. Hab. Darjiling!!!

*Bacillus Scytale*, Bates, ♀, l. c., p. 328, pl. xlv, fig. 9. Hab. Ceylon.

*Bacillus leprosus*, Gerst., ♀, Arch. für Naturgesch. xxxv, p. 211. Hab. Zanzibar.

*Bacillus Gerhardii*, Kaup, ♂, Proc. Zool. Soc. Lond. 1866. Hab. New Zealand.

*Bacillus Geisovii*, ♂, Kaup, loc. cit.,

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each side of the body as far as the commencement of the fourth abdominal segment where it becomes somewhat interrupted; the interval between this line and the margins of the dorsal area of the body is silvery white; below, the insect is of a uniform light yellowish green; above, between the brown lateral lines, darker green; the meso- and meta-notum are indistinctly carinate down the middle, and under a moderately powerful lens appear to be marked with delicate wavy transverse striæ; the striation becomes less distinct on the abdominal segments. The abdomen is slightly expanded at the junction of its 4th and 5th segments from which latter it sensibly decreases in width to the apex of the seventh, whence it widens to a trifling extent; seventh segment equal to about  $1\frac{1}{3}$  times the 8th, exactly twice as long as the 9th which is obtusely rounded at the extremity and above presents a median and two lateral less distinct ridges; these latter curve inwards at their apical ends, enclosing a shield-shaped area. Posterior margin of the terminal ventral segment slightly emarginate.

Legs simple, of excessive tenuity; anterior very slightly longer than the posterior pair; intermediate shorter by the length of their own tibia than the former. Cerci long, obtuse, prorected beyond the apex of the abdomen, slightly forcipated and grooved at the sides.

Total length 22 lines; head  $1\frac{1}{4}$ , prothorax 1, mesothorax  $4\frac{1}{2}$ , metathorax  $3\frac{1}{2}$ , abdomen  $9\frac{1}{2} + 2\frac{1}{4} = 11\frac{3}{4}$ ; antennæ  $3\frac{1}{2}$ .

Hab. Murree, Panjáb. One specimen collected by Dr. W. Waagen.

*BACILLUS HISPIDULUS*, n. sp. Pl. VII. Figs. 2-3.

♂ Filiform, slender, sordid, with a dark-green median dorsal streak, extending from the apex of the mesothorax to the extremity of the abdomen. Head sub-ovate, with the sides slightly convergent posteriorly, antennæ 16-jointed, joints very distinct; first joint depressed but not expanded; second twice as long as broad, cylindrical, its proximal end the broader. Mesothorax hardly narrower in front than behind. Meso- and meta-notum with a raised median line and a few minute tubercles on their lateral margins. Abdomen cylindrical and filiform to the apex of the 6th segment, whence it suddenly expands to the junction of the 7th and 8th, whence it narrows to its truncate extremity which appears to be constricted between the 8th and 9th segments; six basal segments slightly expanded at their articular ends; 9th segment strongly carinate; the cerci curved and projecting at its postero-lateral angles.

Legs long, slender, and simple; first joint of anterior tarsi greatly elongated; rather more than twice as long as the remaining joints taken together.

Total length  $24\frac{1}{2}$  lines, antennæ 4, head  $1\frac{1}{4}$ , proth. 1, mesoth.  $5\frac{1}{2}$ , metath.  $4\frac{1}{4}$ , abd.  $10\frac{1}{4} + 2\frac{1}{4} = 12\frac{1}{2}$  lines.

♀ Much more robust, with a well-defined median raised dorsal line along the whole length of the body, antennæ absolutely shorter than those of the male, but with the basal joint strongly carinate and more expanded. The mesothorax is visibly attenuated in front from the commencement of its apical third, meso- and meta-notum with a few minute warts along their lateral margins; meso- and meta-sternum with a few similar warts scattered over their surface.

The abdomen is sub-fusiform, depressed to the apex of the 6th segment, and has a distinct ridge, which can also be detected on the thorax, running internally and parallel to the lateral margins of all its dorsal segments except the last; its five posterior segments have another ridge on each side midway between their sides and the median ridge. The posterior margin of the sixth ventral is produced in the middle into a sharp spine with a broad base. The seventh segment is nearly as long as the two last together; these are subequal. The last is subtruncate at its extremity beyond which projects a small triangular azygos plate carinated above. Cerci, in form of a tall four-sided pyramid with its angles rounded, project at the postero-lateral angles of last segment.

Operculum spatulate in outline and flat below, with a broadly rounded extremity, not extending beyond the middle of the last segment.

First joint of tarsus in anterior legs as in the male. The body is covered with very short setæ in both sexes.

Total length, 34 lines, ant.  $3\frac{1}{2}$ , head  $2\frac{1}{4}$ , proth.  $1\frac{1}{2}$ , mesoth.  $7\frac{1}{4}$ , metath.  $5\frac{1}{4}$ , abd.  $15\frac{1}{4} + 2\frac{1}{2} = 17\frac{3}{4}$  lines.

*Hab.*—South Andaman. Three males and three females, of which two were taken *in copulâ*.

I have received from Dr. Stoliczka, who obtained it from the Arakan coast, an insect differing from the male insect above described only in its greater length, in the absence of tubercles on the thorax, and in having two more joints to the antennæ; the measurements are as follows:

Total length 32 lines: ant. 6, head  $1\frac{1}{4}$ , proth.  $1\frac{1}{4}$ , mesoth.  $7\frac{3}{4}$ , metath. 6, abd.  $13 + 2\frac{3}{4} = 15\frac{3}{4}$  lines.

BACILLUS OXYTENES, n. sp. Pl. V. Fig. 3.

♀ Excessively long and slender. Head unarmed, narrow, almost cylindrical, being but slightly broader in front than posteriorly, notched behind in middle. Antennæ 28-jointed, as long as the terminal segment of the abdomen; first joint depressed, carinated above and expanded, second longer than broad, also depressed. Mesothorax much longer than the metathorax, sparsely granulated above and below, slightly expanded at the insertion of the legs, otherwise of perfectly uniform width; meta-thorax with only a few scattered granules above and below; meso- and meta-notum with a dark raised mesial line. Abdomen long, perfectly smooth, very gradually and

regularly attenuated from its base to its almost indescribably acute, deeply-cleft, slightly recurved, and strongly compressed extremity. The seventh segment is hardly twice as long as the 8th, which is about a fifth of the length of the last; this has a perceptible upward curvature and is cleft nearly to the insertion of the minute conical *cerci*. The operculum is subdepressed, acutely pointed at the extremity, carinated below and reaches the commencement of the middle third of the last segment, where the *cerci* are inserted.

Legs long, but rather stout as compared with the body, triquetrous; the fore femora are serrated for more than two-thirds of the length of the straight portion, intermediate femora with two or three triangular spines close together above near the base; posterior ones with one or two. Tibiæ with a well defined but not very salient foliaceous carina below; four posterior ones with minute spinules on all their crests. The right middle leg is a reproduced limb, having but four joints to the tarsus and a single spine on the femur.

Total length of the body 4 in. 9 lines; antennæ  $6\frac{1}{4}$ : head  $2\frac{1}{2}$ ; proth. 2; mesoth.  $11\frac{1}{4}$ ; metath.  $8\frac{3}{4}$ ; abdomen  $23\frac{1}{2} + 10 = 33\frac{1}{2}$  lines.

Abdomen: rest of body :: 1.4255 &c.: 1.

*Hab.*—Pegu Yomah, collected by Mr. S. Kurz, the botanist at the Calcutta Botanic Garden, during his recent botanical tour through Burma and the Tenasserim Provinces.

In the form of the terminal segments of the body, this species approaches *B. Regulus*, Westw. ♀ (Cat. p. 8, Pl. XXII).

#### BACILLUS LEVIGATUS, Pl. V. Fig. 4.

♀ Very slender and cylindrical and smooth. The head is armed with two minute blunt erect spines between the eyes, and is slightly narrowed behind; its posterior margin with 3 or 4 notches. Antennæ exactly half the length of the mesothorax; first joint depressed and somewhat expanded, feebly carinate above, its outer margin more convex than the inner; second joint fully as broad as long, depressed.

Abdomen extremely long and slender, tapering very gradually to the apex of the seventh segment; whence it very slightly expands to the basal half of the last which suddenly narrows to its extremity; this is divided by a short cleft into rounded tips. 7th dorsal segment equal to 8th, half as long as the last which is carinate above. *Cerci* pointed. Operculum narrow depressed, obtusely pointed, reaching the end of basal third of last segment.

Legs simple; anterior pair tolerably long; anterior femora serrated for three-fourth of the length of upper crest. The first joint of anterior tarsi is twice the length of its homologue in the intermediate legs, which is rather shorter than that of the posterior legs.

Total length of body 2 in. 10 lin, ant.  $3\frac{1}{4}$ , head  $1\frac{3}{4}$ , proth.  $1\frac{1}{4}$ , mesoth.  $6\frac{1}{2}$ , metath. 5, abd.  $15\frac{3}{4} + 3\frac{3}{4} = 19\frac{1}{2}$  lines.

*Hab.*—Samagooting, Naga Hills, Assam. One immature specimen collected by Capt. in Butler. This species is closely allied to *B. Westwoodii*.

BACILLUS WESTWOODII, n. sp. Pl. VI. Fig. 3.

♀ Elongate, slender, sub-cylindrical, convex. Head narrowed from the eyes to the base, with its sides slightly convex, armed between the eyes with two forwardly and slightly outwardly directed spines; and with its posterior margin faintly notched in the middle and on each side. Antennæ more than half as long as the mesothorax, from 21 to 26-jointed; first joint carinated above and depressed but not expanded; second joint nearly as broad as long; the rest filiform with the exception of the last which is thickened at the tip. Mesothorax slightly narrowed in front and, with the metathorax, somewhat expanded at the insertion of the legs. The abdomen is narrowed from the base to the apex of the first segment, expands again to the apex of the second, maintains pretty much an uniform width for the next two or three segments and finally gradually tapers to a point. The seventh dorsal segment is twice the length of the eighth, but hardly exceeds the last. This is cleft and slightly compressed at the extremity. The operculum is somewhat boat-shaped, below strongly carinate for its posterior half, and comes into such close and complete opposition with the margins of the terminal dorsal segments, with which it is coincident, as to conceal from view the genital parts, permitting only the tips of the *cerci* to emerge. Legs triquetrous, their edges beset with short cilia; straight portion of upper edge of fore femora serrated nearly to the apical end; the intermediate and hind femora have a triangular spine below at the apex; all the tibiæ have a foliaceous carina arising near the base and gradually subsiding towards the apex; the posterior ones have sometimes a triangular foliaceous spine near the base above; the intermediate ones sometimes one, two or none. Tarsi triquetrous; first joint of the anterior pair as long as the others taken together; in the other legs it is not nearly as long as the united lengths of the remaining joints.

Total length of the body 4 in. 8 lines, antennæ  $6\frac{1}{4}$ , head  $2\frac{1}{2}$ , proth. 2, mesoth. 11, metath. 8, abdomen  $27\frac{1}{2} + 5\frac{1}{2} = 33$ .

Abdomen: rest of body :: 1.4042: 1.

In the specimen described, the intermediate legs when stretched straight backwards, reach to the commencement of the posterior third of the fourth abdominal segment, the posterior legs to the *cerci anales*; in other specimens the intermediate legs extend rather beyond the fourth segment, and the posterior ones beyond the extremity of the abdomen.

*Hab.*—Nine adult and three immature females were captured by my

private collector during the months of August, September and October last in the neighbourhood of Port Blair on South Andaman. An immature insect collected by Mr. Homfray at Camorta, Nicobar Islands, differs so slightly from larvæ, beyond doubt belonging to the present species, that I hesitate to give it another name.

**BACILLUS (BACULUM) ARTEMIS, Westwood. Pl. VI. Figs. 1-2.**

*Bacillus? Artemis*, ♀, Westwood, Cat. of Orthopterous Insects in the British Mus., 1859, Pt. I, Phasmidæ, p. 10, pl. xxvi, fig. 9, 9a.

*B. patellifer*, Bates, ♀, Trans. Lin. Soc. London, 1865, Vol. xxv, Pt. I, p. 328.

Numerous specimens of an insect remarkably abundant in the moist, deep valleys of Sikkim, in Cachar, in the Bhutan Doars and at Samagooting in the Naga Hills, agree in every respect both with Bates' description of *B. patellifer* and with *Bacillus? Artemis* described and figured by Prof. Westwood from a dried and mutilated example now in the Hopeian collection at Oxford. The comparison of dried specimens in my possession with Westwood's figures shows that the compression of the three terminal segments is mainly, and that the depression and enlargement posteriorly of the sixth dorsal are entirely effects of drying. Bates omits to mention that the terminal dorsal segment is grooved above in the middle line, and that the emargination in its posterior border is occupied by a small carinated azygos plate with a rounded hinder margin; the state of preservation of Prof. Westwood's specimen may probably account for his omission to mention not only these points but even the emargination itself. The following are the dimensions of a specimen from the Naga Hills figured on plate vi.

Total length 4 in. 5 lines, ant. 7 lines (25-jointed), head  $2\frac{1}{2}$ , proth. 2, mesoth.  $10\frac{1}{2}$ , metath. 8, abd. 2 in.  $0\frac{1}{2}$  line + 6 = 2 in.  $6\frac{1}{2}$ .

A variety found in all the districts mentioned above with the exception of the Bhutan Doars is figured side by side with the typical form on the same plate as showing the value of the armature of the legs unsupported by other characters in making a species; almost every gradation from the extremely acanthophyllous and spinose condition of the legs there depicted to their almost completely unarmed condition in fig. 1 being to be met with. Fig. 2 a, 2 b, 2 c may represent the same parts of fig. 1.

**BACILLUS (BACULUM) INSIGNIS, n. sp. Pl. V. Figs. 1-2.**

♀ Extremely robust, greatly elongated, subcylindrical, convex. Head remarkably stout, conspicuously narrowed from the eyes to the base, the sides being almost straight, armed between the eyes with two stout-based, acuminate, forwardly-directed and incurved spines or horns, notched posteriorly in the middle. Antennæ 25-jointed; basal joint depressed, expanded, and carinated above. Mesothorax gradually attenuated from the

base forwards ; metathorax of uniform width ; both are marked above with a fine raised median line which is continued on to three or four of the basal segments of the abdomen.

The abdomen is attenuated from the base of its third segment to the extremity. The three terminal segments are compressed ; the first of these is twice as long as the second ; the second  $1\frac{1}{3}$  times as long as the last which is grooved above in the middle line and has its posterior margin divided into two rounded lobes by a narrow fissure filled by the median carina of a small azygos plate ; the upper contour of this last segment meets that of the preceding at a very obtuse angle. The operculum extends about one line beyond the abdomen ; its posterior half is greatly compressed, so much so at its sub-truncate extremity that its opposite inner faces are in complete contact. *Cerci* minute, conical, their tips alone projecting slightly between the posterior and middle thirds of the last abdominal segment.

Legs stout, triquetrous ; upper and lower crests of fore femora inconspicuously serrate towards the base ; the intermediate femora are curved, their upper margin forming the convex curvature, and below at the base present two conspicuous divergent foliaceous expansions with rounded free margins, one springing from each crest and a conical spine at the apex ; the posterior femora are but feebly curved and exhibit but a faint indication of these foliaceous lobes, and have also a spine at the apex below ; all four posterior femora appear to be regularly tricarinate above, owing to the very close approximation of their two upper crests. The intermediate tibiæ have a large foliaceous lobe like a tooth of a saw near the base above, which is much reduced or even absent in the posterior pair ; all the tibiæ have a sharp, well-developed foliaceous carina, on their basal third below, which in the fore tibiæ traverses the whole length of the joint. The first tarsal joint in the fore-legs is hardly as long as the other joints taken together ; in the other legs it is not nearly as long.

The intermediate legs if stretched backwards would reach only just beyond the apex of the third, the posterior ones to the apex of the sixth abdominal segment.

Total length of body 7 in.  $2\frac{3}{4}$  lines ; antennæ  $8\frac{1}{2}$  ; head  $3\frac{1}{4}$  ; proth.  $2\frac{1}{2}$  ; mesoth.  $16\frac{1}{2}$  ; metath. 14 ; abd.  $40 + 9\frac{1}{2} + \text{operc. } 1 = 50\frac{1}{2}$ .

Abdomen : rest of body :: 1·3655 &c. : 1.

*Hab.*—Samagooting, Naga hills, Assam, (Captain Butler) ; Sikkim (Mr. Mandelli) ; and the valleys around Cherra Punji in the Khasi hills (Lieut. Bourne).

BACILLUS (BACULUM) PENTHESILEA, n. sp. Pl. V. Fig. 5.

♀ Elongate, stout, cylindrical, smooth, with a faint raised median line extending from the anterior extremity of the mesothorax nearly to tip of



the abdomen. Head not so stout as in the preceding species, armed between the eyes with two minute conical spinules or tubercles, its posterior margin presents 3 notches giving it the appearance of being bi-tuberculate, narrowed from the eyes to the base. Antennæ very slender, as long as the three terminal abdominal segments taken together, 30-jointed; first joint somewhat expanded; second minute, hardly longer than broad, followed by 28 filiform joints gradually increasing in length to the apical one. Mesothorax uniform in width except at the insertion of the legs where it is expanded. Metathorax broader than the mesothorax and expanded at each end.

Abdomen very long, attenuated from the base of the 5th segment; the three segments anterior to this are uniform in width and broadest of all, broader even than the basal segment which is just perceptibly concave at the sides; the 6th ventral has a rounded punctate callosity posteriorly; the ante-penultimate segment is as long as the two last taken together; the last is grooved above in the middle line, has its posterior angles pointed and rather deflexed than projecting outwards and its hinder margin sub-angularly emarginate, the emargination being filled by an azygos plate which is carinate, has its free margin straight and projecting beyond the acutely angular tips of the segment, and its postero-lateral angles rounded. *Cerci* tolerably salient, obtuse. Operculum subcompressed and carinate for nearly its posterior half, rounded but not compressed at the tip which barely reaches as far as the bottom of the emargination in the last segment.

Legs slender; anterior pair triquetrous; the two other pairs subtriquetrous, their upper crests being not nearly so closely approximated as in the preceding species. The intermediate legs, stretched straight backwards so as to be parallel with the long axis of the body, reach to the middle of the 4th, the posterior ones to that of the 7th segment. The anterior femora are denticulate to beyond the middle of their upper and lower crests; the four posterior pairs are devoid of spines or foliaceous lobes except at their apical ends below where there is a short denticulate elevation, all the tibiæ have a lamellar carina arising and attaining its greatest development near the proximal end; and the distal halves of the four posterior ones are acutely spinulose on all edges. The first joint of the tarsus of the fore-legs is fully as long as, of the intermediate legs shorter than, of the posterior legs almost as long as, the remaining joints together; but the first tarsal joint of 1st legs is longer and slenderer than those of the 2nd and 3rd pairs.

Colour green with the prosternum, bases of all the legs, the stigmata, the spines on the head and the interval between them, and the apex of the abdomen blackish-brown.

Total length, 6 in.  $10\frac{3}{4}$  lines; antennæ, 9 lin.; head,  $3\frac{1}{2}$ ; proth.  $2\frac{1}{2}$ ; mesoth.  $15\frac{1}{4}$ ; metath.  $13\frac{1}{2}$ ; abdomen 3 in. 3 lin. + 9 lin. = 4 in.; ant. legs: femur 23 lin. + tibia 22 + tarsus  $6\frac{3}{4}$  = 4 in.  $3\frac{3}{4}$  lin.; inter. legs: f.  $17\frac{3}{4}$  + tib.

$16 + t. 4\frac{3}{4} = 3 \text{ in. } 2\frac{1}{2} \text{ lin.}$ ; post. legs: f.  $20 + \text{tib. } 18 + \text{tar. } 5 = 3 \text{ in. } 7 \text{ lines.}$

Abdomen: rest of the body: : 1·3012 &c.: 1.

*Hab.*—A single specimen was collected in the neighbourhood of Baxa, Bhután Doár, by Dr. Cameron.

BACILLUS (BACULUM) FURCILLATUS, n. sp. Pl. V. Fig. 6.

♀ Elongate, cylindrical, smooth. Head unarmed, narrowed from the eyes to the base, with three notches on its posterior margin. Antennæ long and fine, as long as the metanotum proper, or as the two basal segments of the abdomen together, 24-jointed; first joint depressed, not greatly expanded, strongly carinate above; second longer than broad, sub-cylindrical; rest filiform. Meso- and meta-notum with a most delicate median line in relief; the former is of uniform width throughout, the latter very slightly expanded posteriorly at the origin of the legs. Abdomen shorter in proportion to the rest of the body than in the two preceding species, cylindrical to the apex of its fifth segment; whence it becomes slightly compressed and attenuated to its furcate extremity. A small azygos plate carinated above and with its posterior margin rounded, fills the bottom of the interval between the arms of the fork, which conceal its sides from view from above. The operculum is boat-shaped; its extremity which is rounded and slightly spread out horizontally, attains the level of the bottom of the fork only.

The legs closely resemble those of *B. Penthesilea*, but the four posterior femora have some widely-placed spinules on both their inferior crests; the intermediate ones reach to the end of the basal third of the 5th, the posterior extend slight beyond the terminal abdominal segment.

Total length 5 in.  $1\frac{1}{2}$  lin.: antennæ 8; head 3; proth.  $2\frac{1}{2}$ ; mesoth.  $12\frac{1}{2}$ ; metath. 10; abd.  $27\frac{1}{2} + 6\frac{1}{4} = 33\frac{3}{4}$ ; ant. legs, 3 in. 7 lin.; inter. legs 2 in. 6 lin.; post. legs 2 in. 11 lin. Colour uniform green.

The abdomen: rest of body: : 1·2162 &c.: 1.

*Hab.*—Baxa, Bhután Doár, collected by Dr. Cameron.

This species is at once distinguished from the two preceding, as indeed these are from one another, by the difference in the structure of the terminal dorsal segment; by the form of the operculum, by the relative length of the abdomen to that of the body, and by the absence of spines from the head.

In the four preceding species to which M. de Saussure's subgeneric term *Baculum* may be provisionally applied, the last dorsal segment of the abdomen is mesially grooved above; the line of structural weakness thus produced, may possibly subserve the purpose of giving greater expansibility to the segment during copulation and oviposition. This peculiarity of structure is present also in *Bacillus* (*Baculum*) *Cuniculus*, Westwood, in *B. (B.) Hyphereon*, Westwood, and in *B. (B.)*

*scytale*, Bates, if one may judge from the published figures of those species. With regard to the last mentioned, it should be noted that Mr. Bates, although he states its affinities to be with the first, at the same time refers it to a totally distinct subgeneric group, *viz.*, to *Ramulus*, de Sauss., in which the abdomen is fusiform and acuminate at the extremity. It is also to be remarked that the species to which *B. scytale* is said to be so nearly related by Bates has turned out not to be a *Bacillus* at all, but a *Lonchodes* very closely allied indeed to *L. pseudoporus*, Westw., if not identical with that species. *Ramulus* is, however, still retained by M. de Saussure for a group of the *Bacilli*, under which *B. humilis*, Westw., *B. carinulatus*, Sauss., &c., have been arranged.

BACILLUS SCABRIUSCULUS, n. sp. Pl. VII. Fig. 1.

Very robust. The integument is wrinkled and studded with granulations and small tubercles. Head thick, coarsely granulated, very little narrowed behind, armed between the eyes with two conical spines, projecting outwards and slightly backwards and with their bases united by a transverse elevation, bi-tuberculate posteriorly. Antennæ as long as the metathorax, 18-jointed, ciliated; the first is depressed and expanded, and strongly carinated; the second joint is about half the length of the first, twice as long as broad and depressed; the rest are slenderer than it and filiform. Prothorax narrower in front, with its anterior margin hollowed for the reception of the head, covered with coarse granules. Meso- and meta-notum irregularly wrinkled longitudinally and covered with small tubercles or coarse granules, marked with a raised median line; the former gradually widens from the apex to the insertion of the intermediate legs; the latter is broader and of uniform width, and a distinct suture divides it into an anterior posterior division (the true 1st abdominal segment = *segment mediare*). Below, the granulations and wrinkles are finer. The abdomen is cylindrical to the fifth or sixth segment, whence it becomes suddenly contracted and compressed, but expands again slightly at the apex which is furcate; the bottom of the fork is occupied by a small carinated azygos plate. The upper contour of the three terminal dorsal segments is extremely convex and the posterior margin of the first two of them is produced into a small process. The operculum is lanceolate in outline as seen from below, its posterior half is carinate and its apex barely reaches the level of the minute *cerci*.

Legs long; anterior pair triquetrous, the rest prismatic; anterior femora serrated to the middle of the upper crest; the intermediate ones are armed with three conspicuous dentate foliaceous lobes above and with three small spines on the other crest, one opposite to each of the foliaceous lobes; the posterior femora have some small spines on each of their upper crests. The

intermediate tibiæ have each two small foliaceous lobes above at the proximal end and immediately opposite to these, below, a single spine; at their distal ends all their edges are spinulose; the posterior tibiæ have two minute spines above at the proximal end and their distal ends are similarly spinulose. All the legs are shortly-ciliate, especially at the extremities.

Total length 4 in.  $1\frac{1}{2}$  lines; antennæ  $7\frac{1}{4}$ ; head  $3\frac{1}{4}$ ; proth.  $2\frac{1}{4}$ , mesoth.  $10\frac{3}{4}$ ; metath.  $7\frac{1}{4}$ ; abdomen  $18\frac{1}{2} + 7 = 25\frac{1}{2}$  lines.

*Hab.*—Naga Hills, Assam. A single specimen was collected by Captain Butler.

### *Explanation of Plates.*

#### Plate V.

Fig. 1. *Bacillus (Buculum) insignis*, ♀, nat. size. 1a, the head seen sideways; 1b, the extremity of the abdomen seen sideways.

Fig. 2. Upper view of terminal abdominal segment of *B. insignis*, ♀, enlarged.

Fig. 3. *B. oxytenes*, ♂, nat. size; 2a, extremity of the abdomen from the side.

Fig. 4. *Bacillus lævigatus*, ♀, nat. size; 4a, b, c, represent same parts as in the previous figures.

Fig. 5. Upper view of terminal abdomen segment of *B. Penthesilea* ♀, enlarged; 5a, side-view of three terminal segments, nat. size.

Fig. 6. *B. furcillatus*, ♂, terminal segment of the abdomen from above, enlarged; 6a, the three terminal segments nat. size seen sideways.

Fig. 7. *B. fuscolineatus*, ♂, nat. size; 7a, the three terminal segments of the body seen from above; 7b, the same seen from the side.

#### Plate VI.

Fig. 1. *Bacillus Artemis*, Westw. ♀, nat. size.

Fig. 2. *Bacillus Artemis*, Westwood ♀, var. nat. size; 2a, the three terminal segments seen from the side; 2b, the terminal segment,  $\times 2$  from above, 2c, the extremity of the abdomen from below, 2d, basal joint of antennæ magnified.

Fig. 3. *B. Westwoodii*; ♀, nat. size; 3a, side view of three terminal segments of abdomen; 3b, the same from below.

#### Plate VII.

Fig. 1. *Bacillus scabriusculus*, ♀; nat. size; 1a, the three terminal segments of the abdomen from the side.

Fig. 2. *Bacillus hispidulus*, ♂, nat. size; 2a, the terminal segments of the abdomen seen sideways; 2b, the same seen from above; 2c, the same from beneath.

Fig. 3. *Bacillus hispidulus*, ♀, nat. size; 3a, 3b, 3c, represent same parts as in fig. 2.



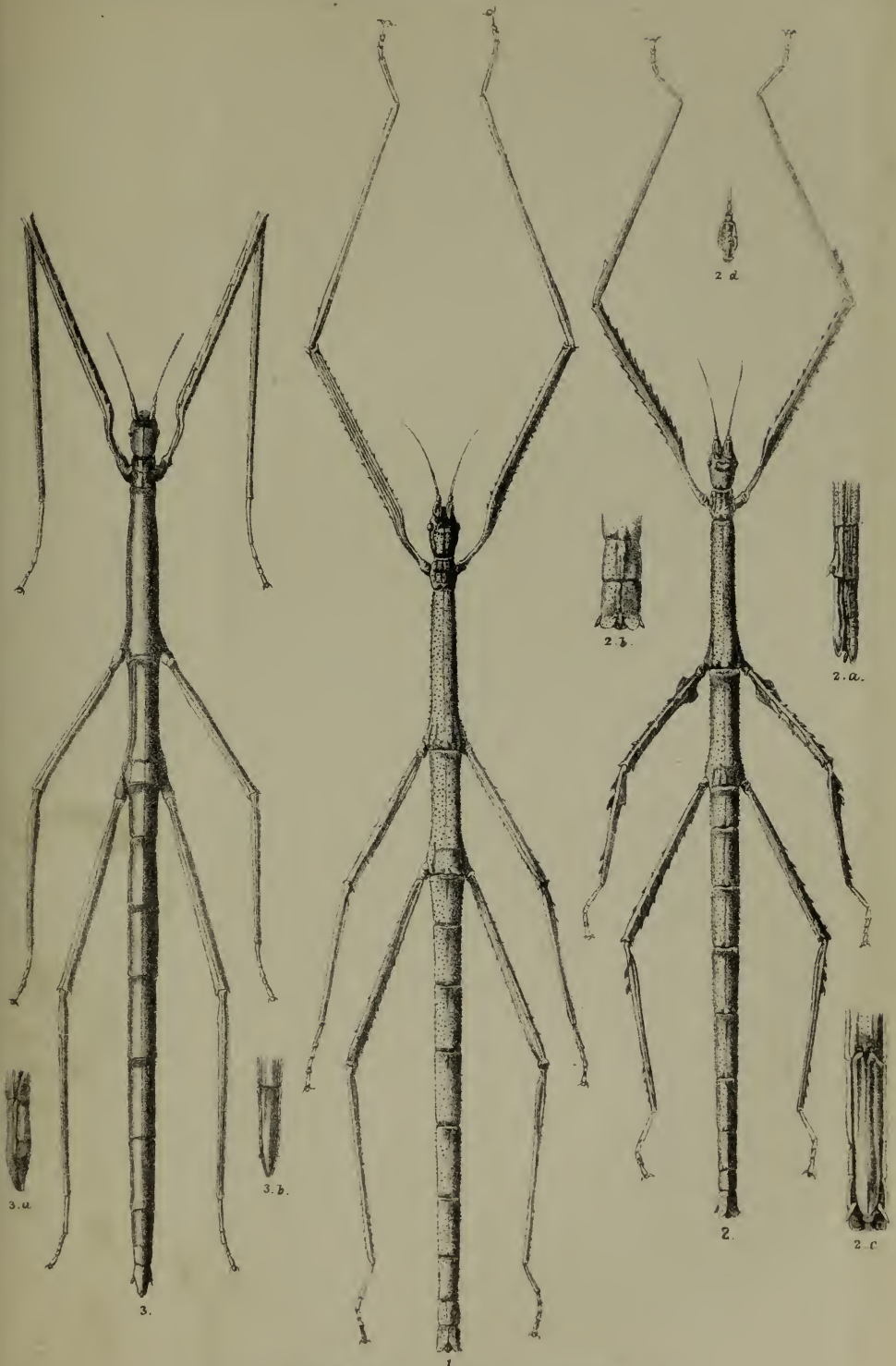


Fig. 1-2 *B. Artemis*, p. 51. Fig. 3 *B. Westwoodii*, p. 50.  
For further explanation see p. 56.

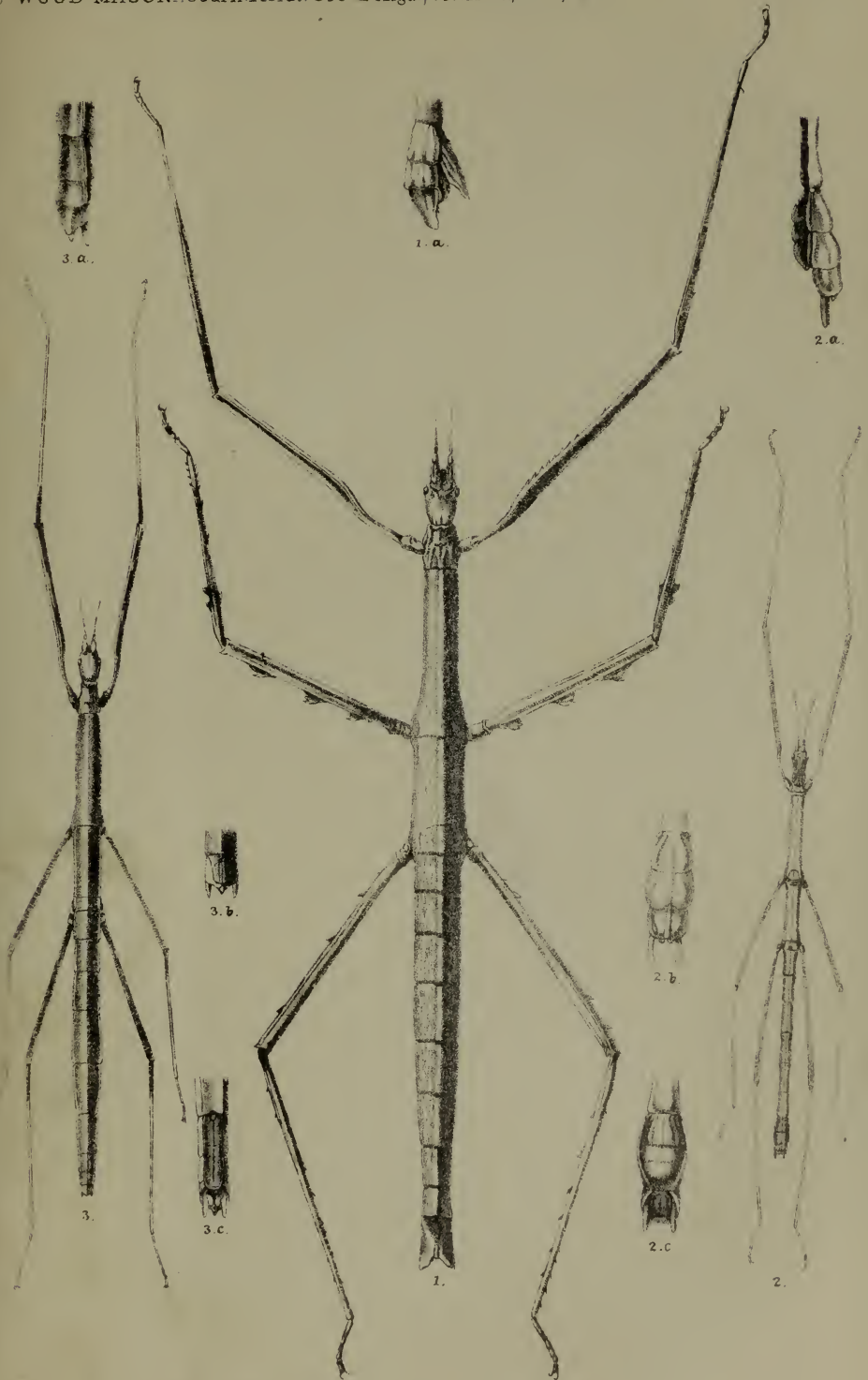


Fig. 1 *B. scabriusculus*, p. 55. Fig. 2-3 *B. hispidulus*, p. 47.  
For further explanation see p. 56.